



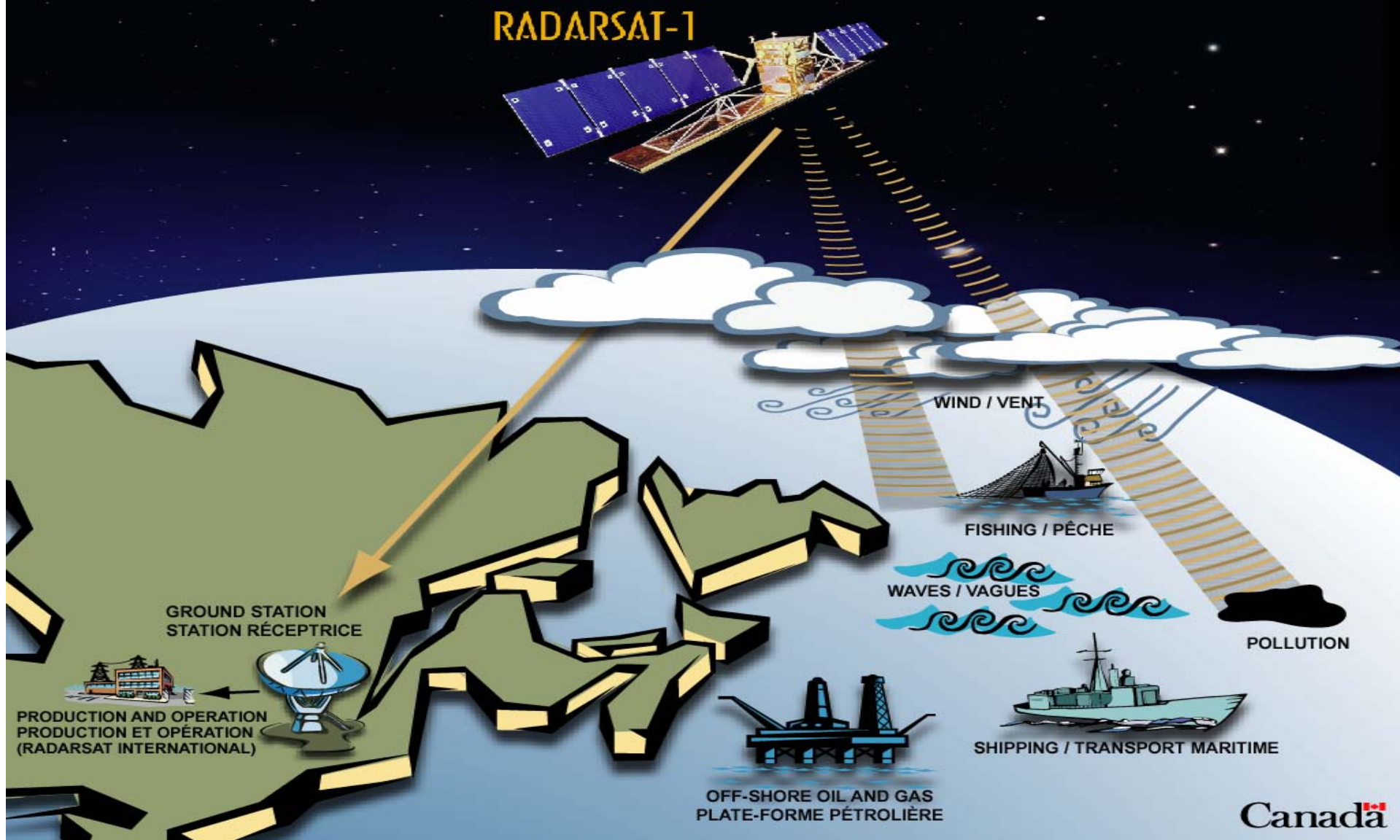
Government
of Canada

Gouvernement
du Canada

RADARSAT
INTERNATIONAL

I-STOP

RADARSAT-1



Canada







The Result


- ◆ tens of thousands of seabirds die at sea every year due to indiscriminate oiling from ships

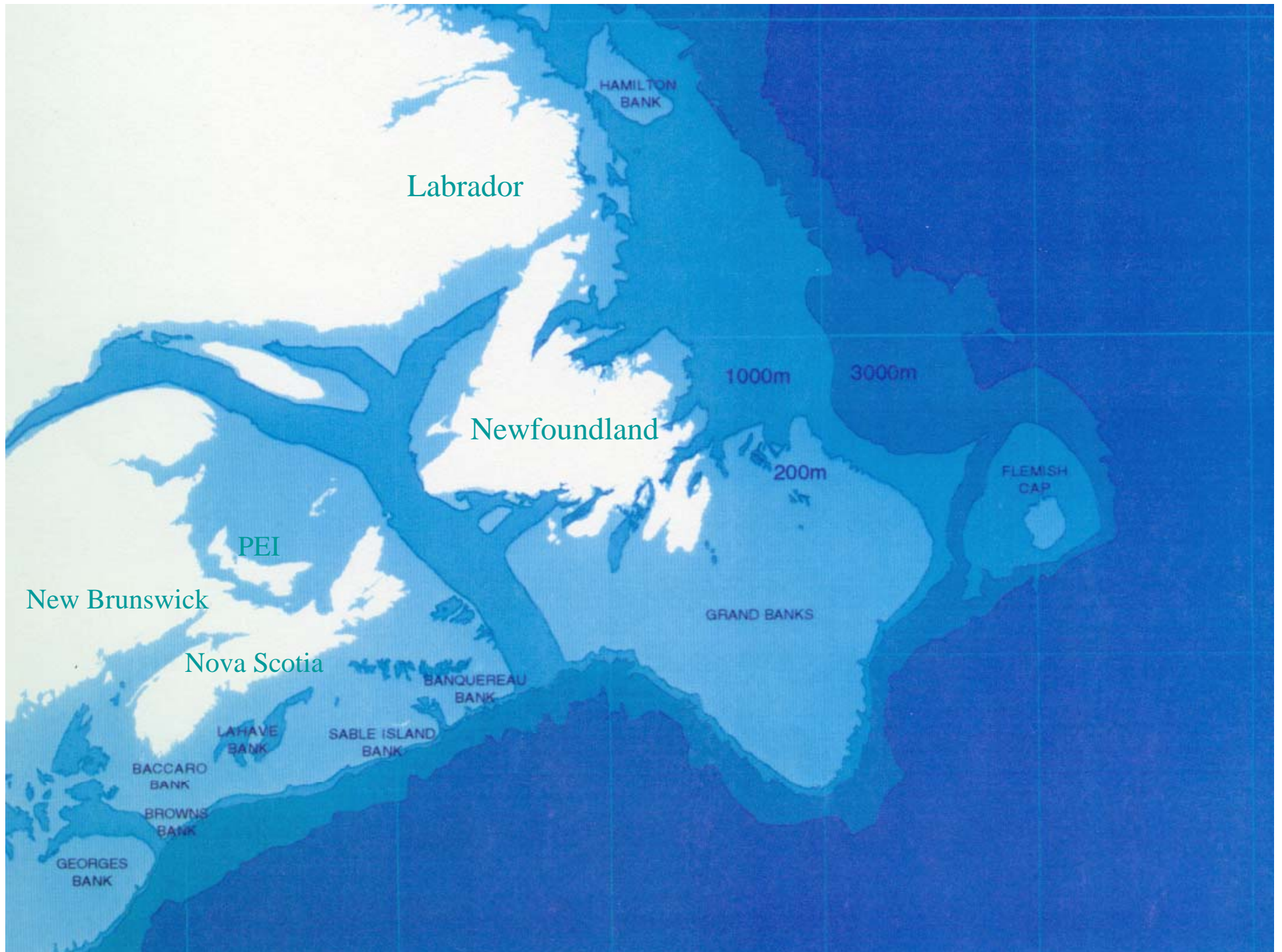


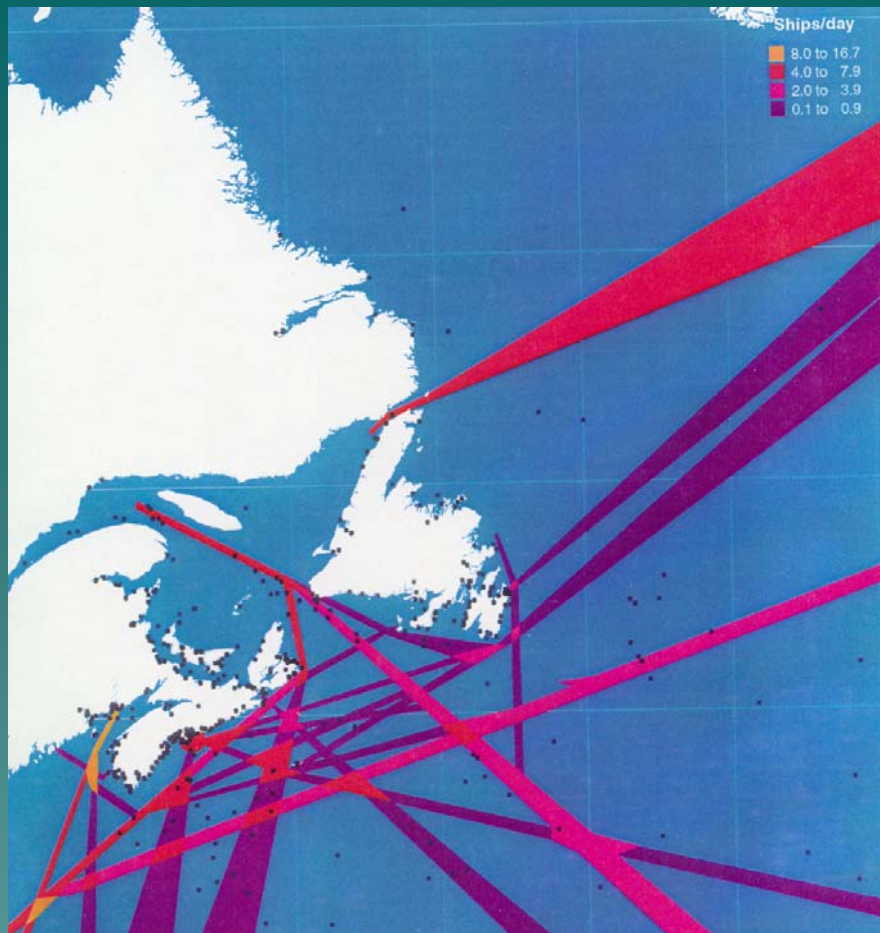
The Resource

The Canadian Continental Shelf is the Crossroads of the North Atlantic for both the shipping industry and seabird populations

some 30 million seabirds from the Eastern Arctic, Labrador, Greenland & Newfoundland winter in these waters off the southeast coast of Newfoundland every year

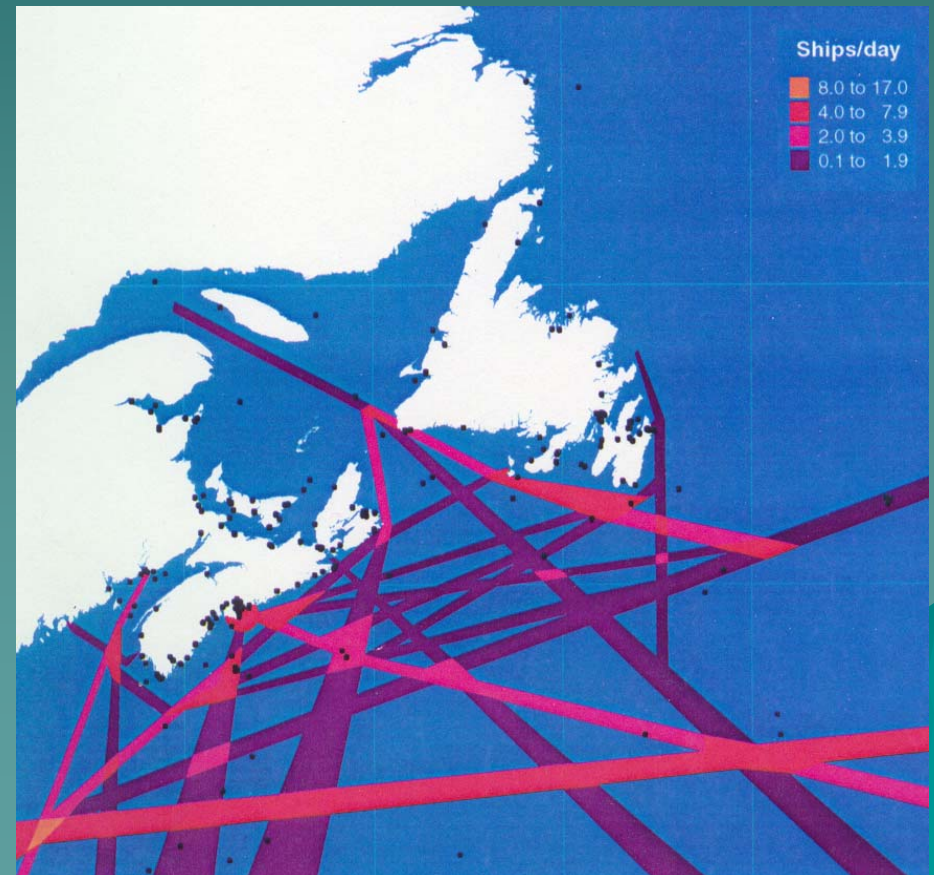




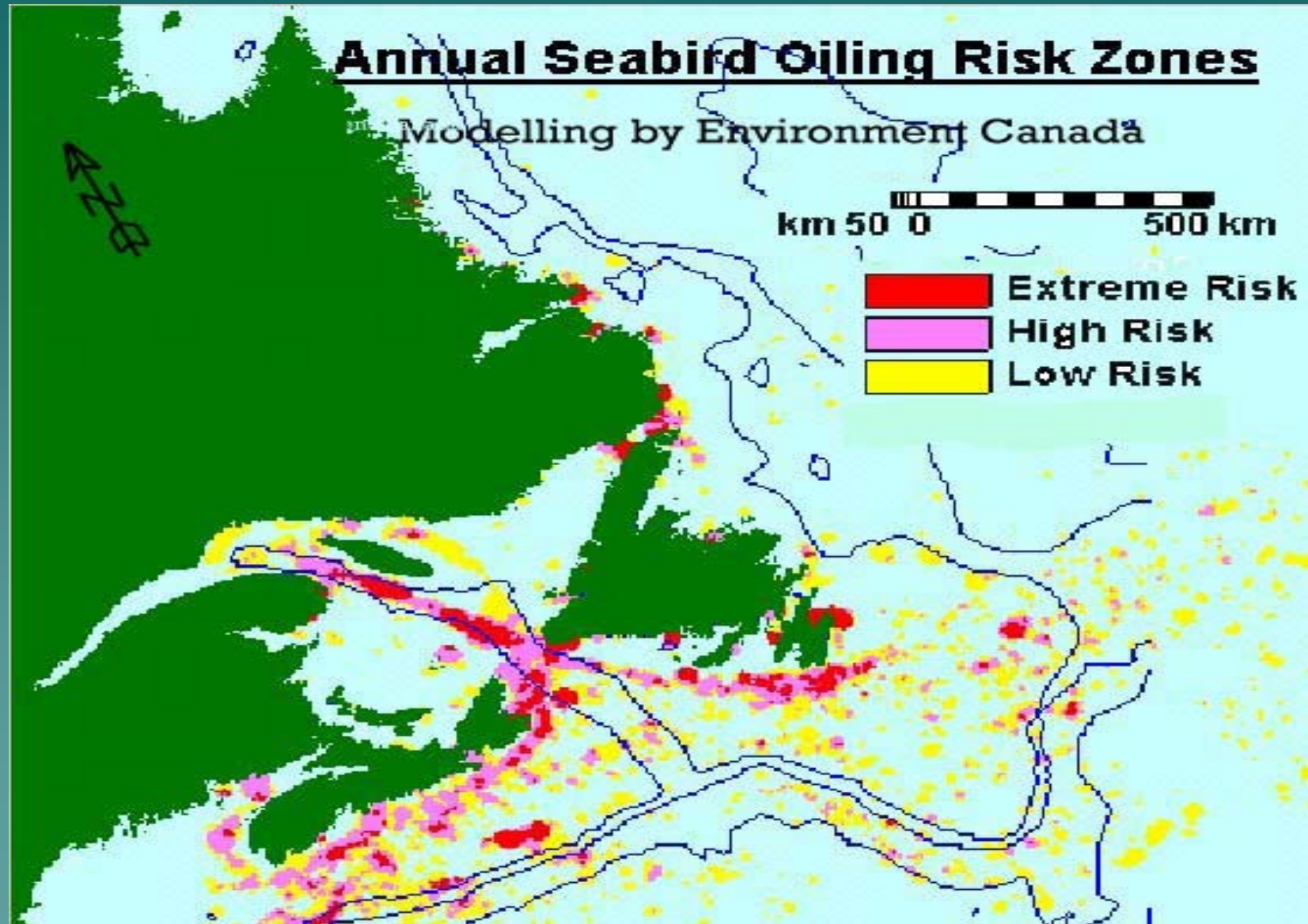


Summer Shipping Routes

Winter Shipping Routes



The Risk



Prevention Oiled Wildlife Committee Recommendation

- ◆ **Recommendation # 7** – “Satellite imaging be explored in an effort to help prevent ship-source and chronic oil pollution and that further studies of established and emerging technologies be undertaken to secure the right fit of technology to our environment in order to enhance surveillance flights.”

BOAS - Marine Oil Pollution

Vision

(where we want to end up)

Oil Pollution in Canadian waters does not kill wildlife or create ecological damage.

Mission of Environment Canada

To create sufficient compliance with Canada's laws to minimize oil pollution and impacts on marine birds and the ecology on which they depend.

Project Collaborators

- ◆ Canadian Coast Guard
- ◆ Transport Canada
- ◆ Department of National Defense
- ◆ RadarSat International
- ◆ Canadian Space Agency
- ◆ Environment Canada
- ◆ Offshore Petroleum Boards

Project Charter

◆ The Blue Print

- outlines how all work together
- described operational procedures within departments
- melding process
- Really no “new” work for anyone

Objectives

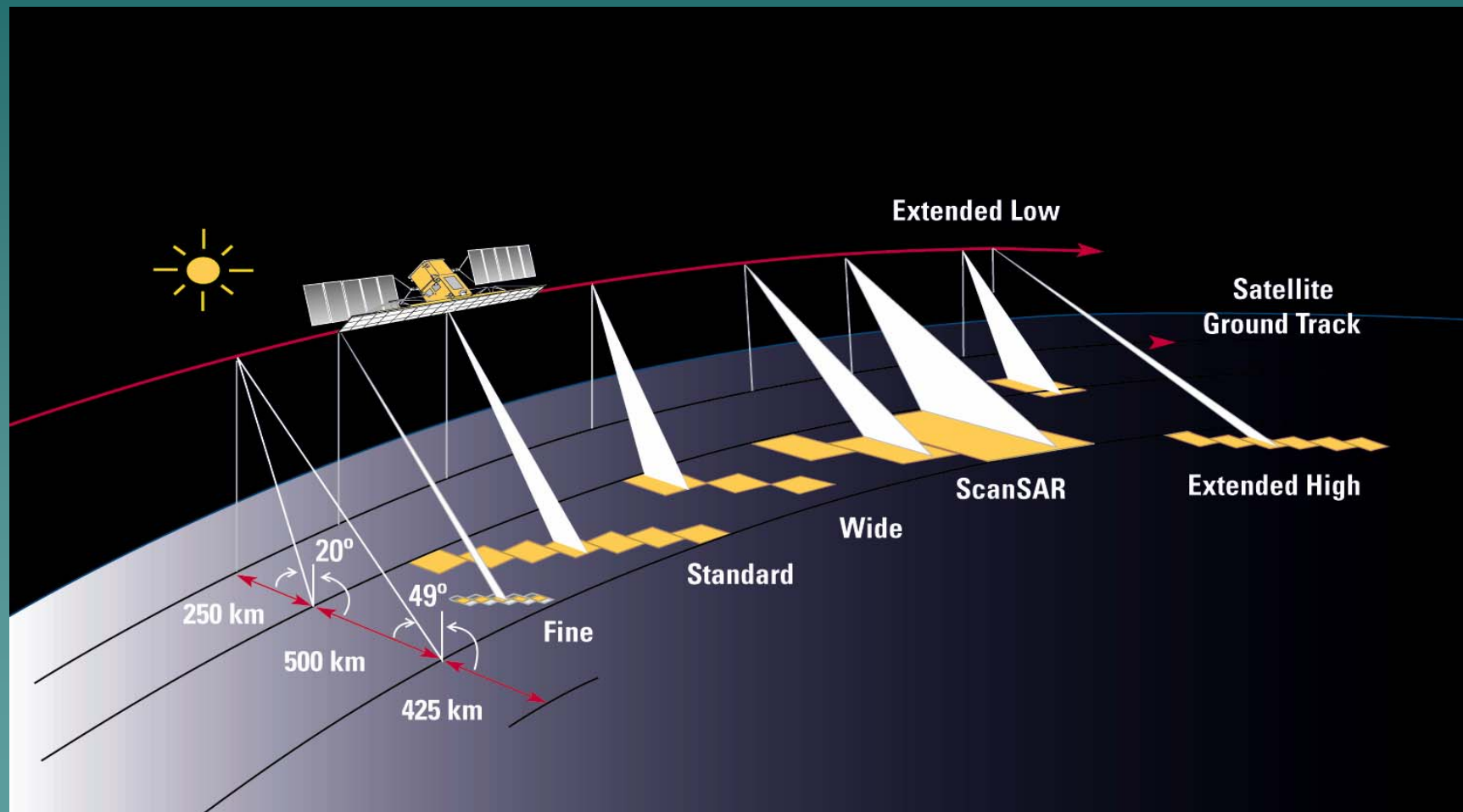
- Increasing or improving the surveillance of the waters off the East Coast through the use of different resources
- Defining the problem in terms of area extent and frequency of dumping
- Determining if RADARSAT can be linked with the CCG's NASP to make the scheduling of the Canadian Coast Guard pollution surveillance flights more effective by providing vector information to sight illegal discharge incidents, ultimately enhancing surveillance efforts

Objectives

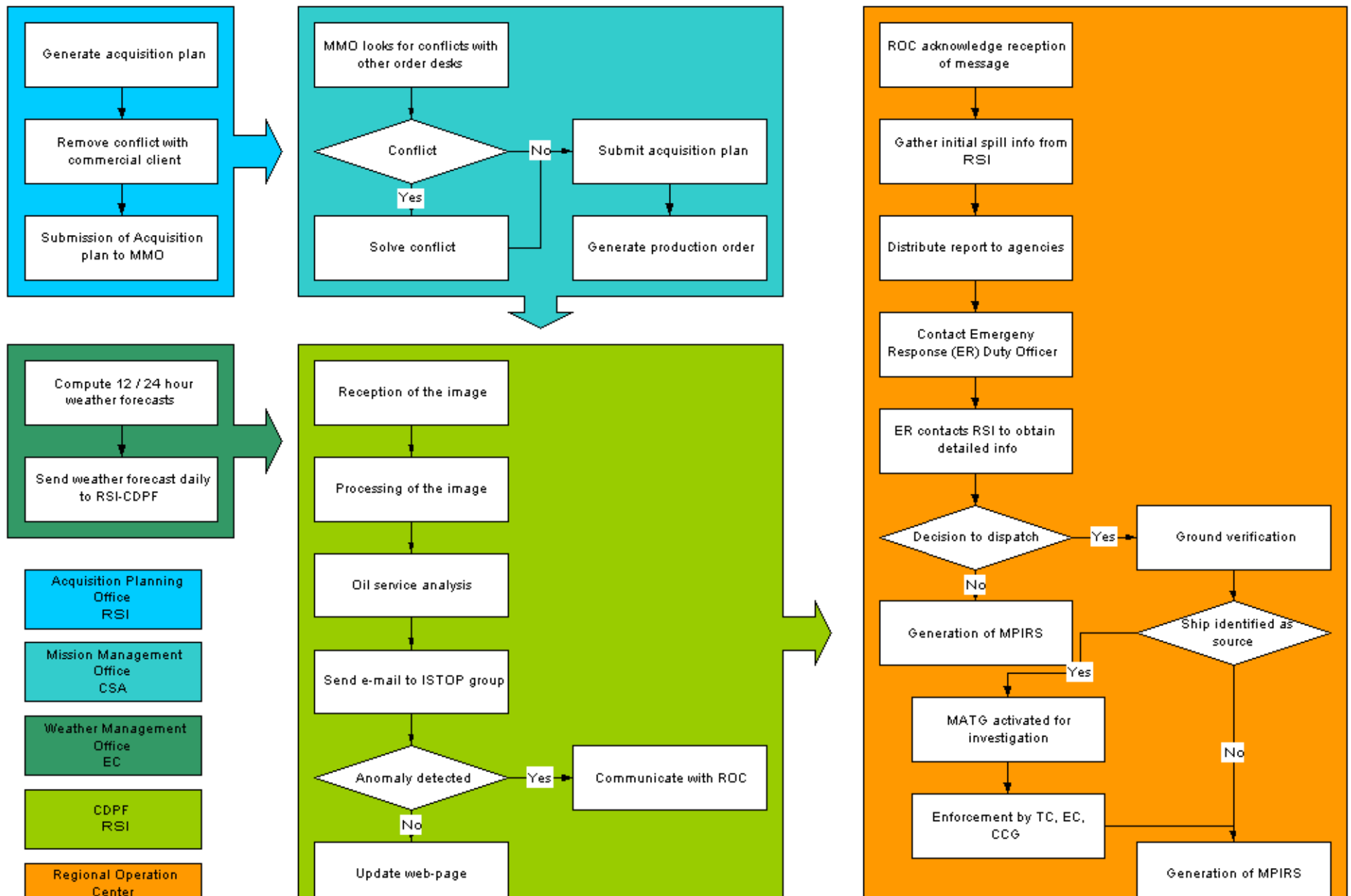
- Ground truthing the effectiveness of satellite surveillance in the detection of illegal pollution from transiting vessels
- Providing a surveillance model for other Canadian waters
- Integrating resources and approaches of mandated agencies to address environmental degradation
- Providing an additional deterrent to illegal discharges of oil at sea

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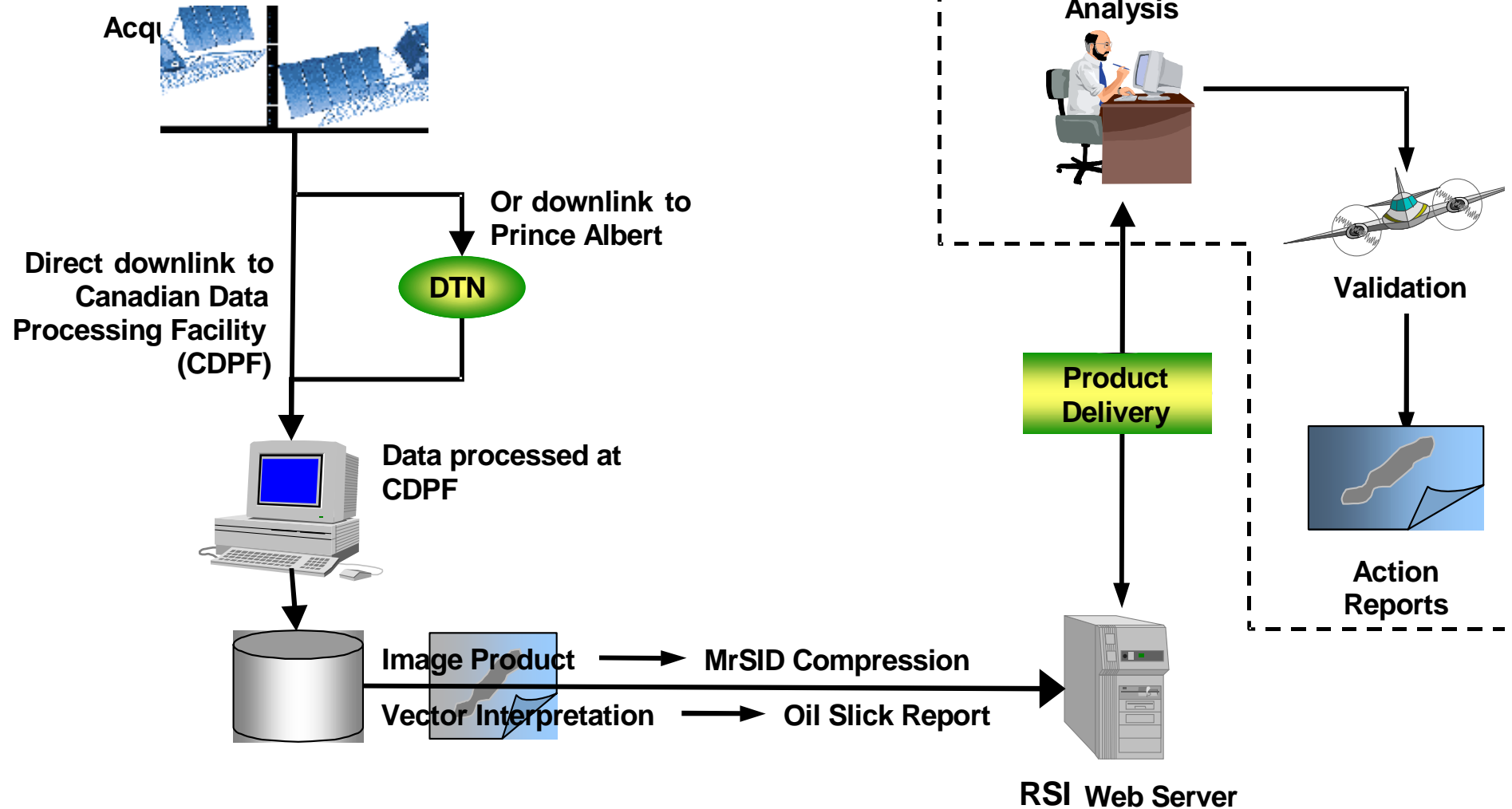
RADARSAT SAR Beam Modes



CDPF Canadian Data Processing Facility
MMO Mission Management Office
MPIRS Marine Pollution Incident - Reporting System
ROC Regional Operations Center
MATG Multi-Agency Task Group



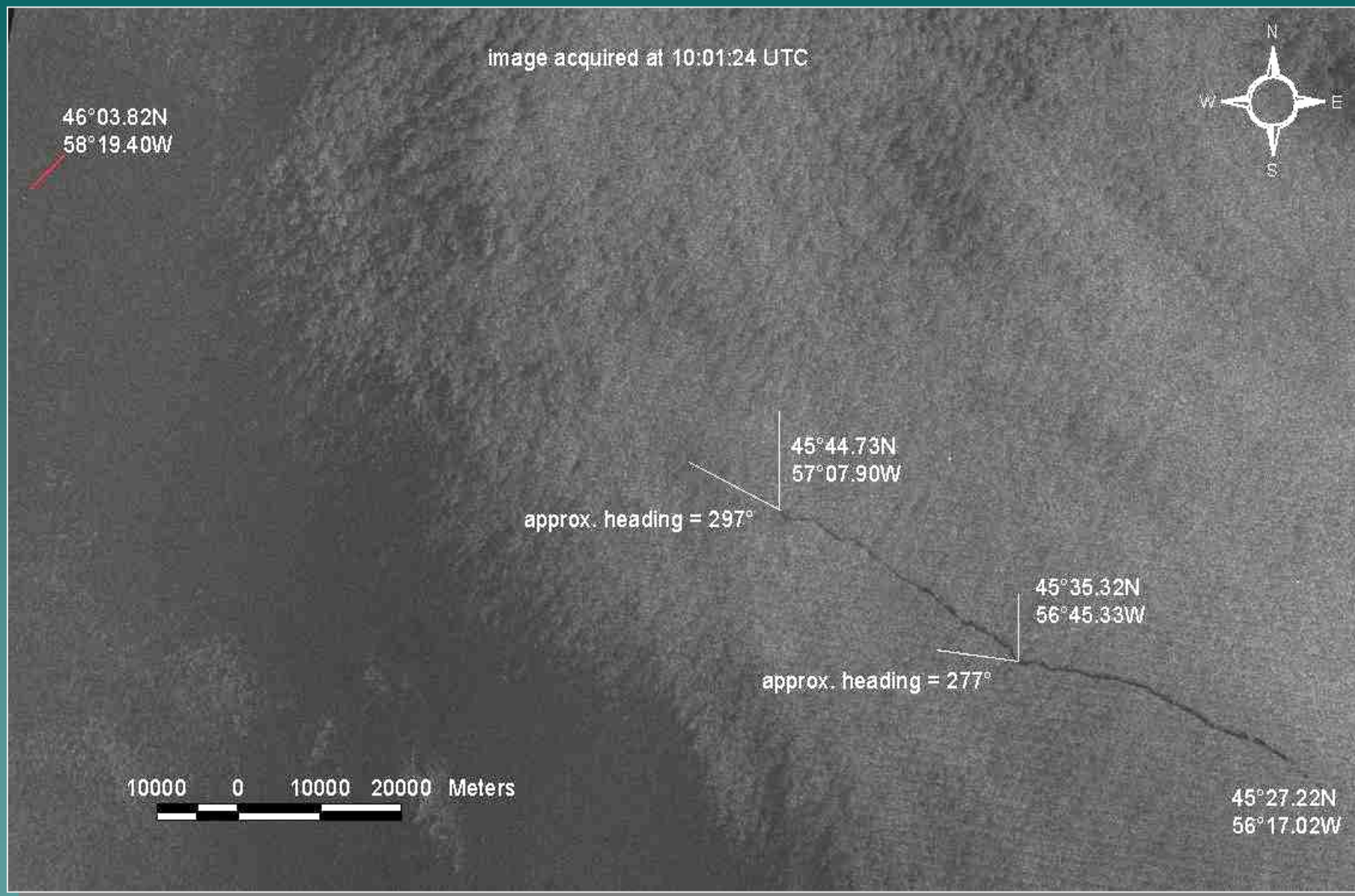
RSI Oil Spill Detection Product Delivery

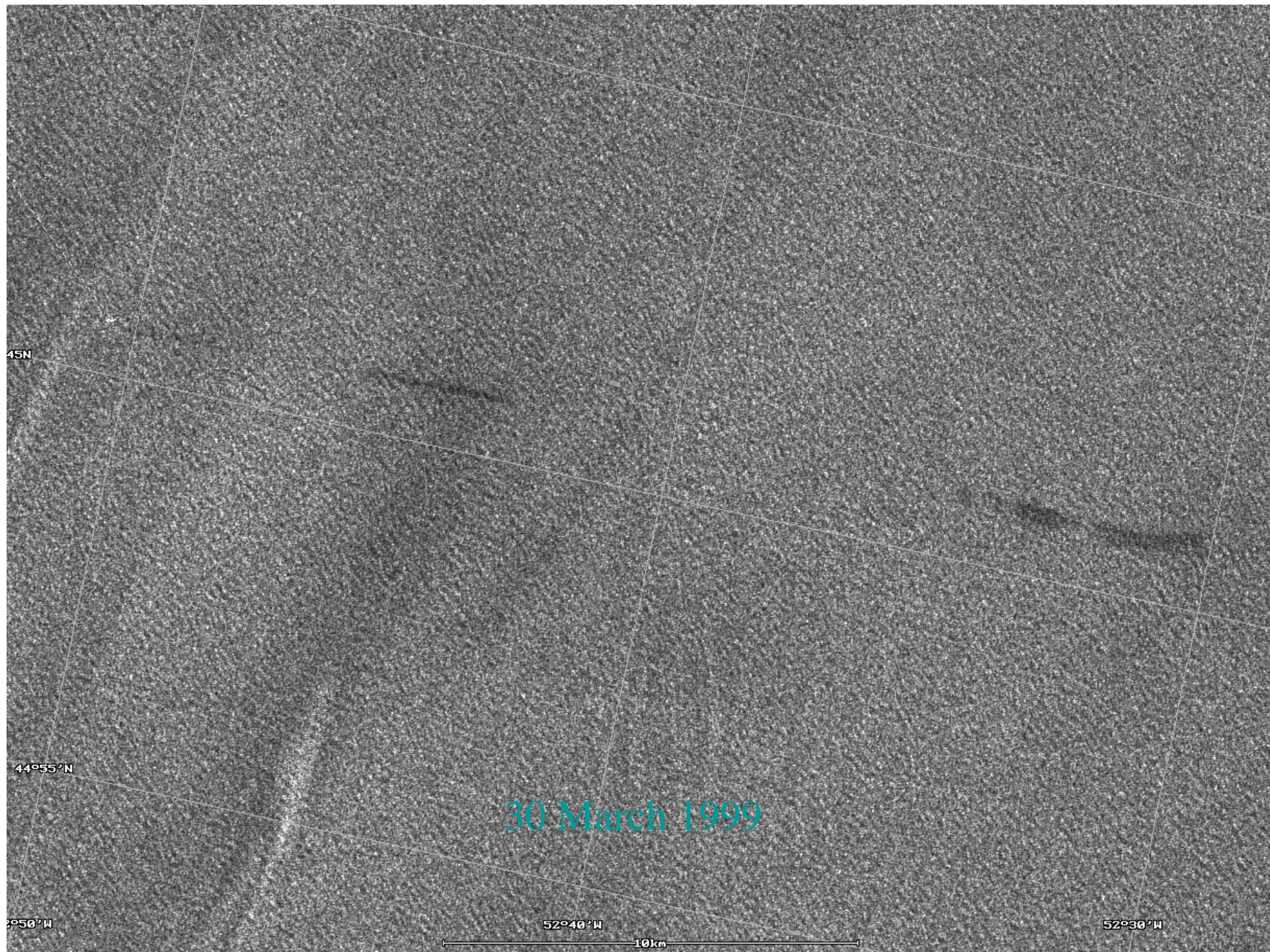


- As soon as the oil spill vectors are ready, RSI uploads the data to the client's server.
- This reduces the elapsed time between data acquisition and delivery of products to the client.
- Normally done during off-peak hours, thus taking advantage of low Internet traffic
- Currently the fastest option for information delivery

Synchronization required

- ◆ Government departments work plans and emergency response
- ◆ Image Acquisition Plan with aircraft availability
- ◆ Aircraft availability with favorable weather
- ◆ IAP not available to everybody
- ◆ Follow-up communication with everyone. (email lists, follow-up calls – etc. etc.)
- ◆ There are politics...





Anomaly Categories

Category # Description *

Category 1A Potential oil present with ship attached

Category 1B Potential oil present with ship in area

Category 2 Potential oil present without source

Category 3 Unsure image is oil **

*Recognize that anomaly category designation based on satellite image interpretation employing visual and computer techniques. Only with verification by aircraft can the designation be confirmed.

**Anomaly present in area; only investigate if CCG assets in general vicinity

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I-STOP Data Analysis Summary Table

#	Acq Date	Acq Time	Orbit #	Ground Truthed		If No, why	Category of Spill	Elapsed Time*	Wind Velocity** & Seastate	Resources Used	Ground Truthing Results
	2003-Sep-08	AM	35727	Yes	_____	_____	1B	5 hours & 34 minutes	280 @ 10 knots 1 metre or less	Aircraft PAL	Conclusive - Aircraft search determined that a slick was present in the area specified by Radarsat. Refer to MPIRS Report N2002-0112 - Positive identification of a vessel was made.
	2003-Sep-09	AM	35741	_____	No	Reported that image was most likely weather.	3	N/A	110 @ 30 knots 3-4 metres	None	Inconclusive - It was originally agreed that resources would not be tasked to ground truth category 3 instances.
	2003-Sep-15	AM	35827	Yes	_____	_____	1B (2 occurrences)	8 hrs & 23 minutes	270 @ 5-10 knots 1-1.5 metres	Aircraft PAL	Inconclusive - AC search resulted in nil detection of oil in specified area. Refer to MPIRS Report N2002-0113.
	2003-Sep-15	PM	35834	_____	No	Anomaly detected late in the evening. NASP Aircraft not equipped with proper equipment to detect oil on water during darkness.	1B Suspected	N/A	270 @ 5-10 knots 1-1.5 metres	None	Inconclusive - Unable to verify - Refer to MPIRS Report N2002-0116.

Statistics

Jul 1 to Dec 31st.2003

◆ Total Anomalies

1A (slick attached to target): 15

1B (slick with target in area): 33

2 (slick without source): 32

3 (possible oil): 46

Ground-truthing results

- ◆ 15 of the anomalies were investigated.
- ◆ 4 were definitely oil
- ◆ 6 were believed to be weather/oil flaring, foam around rigs.
- ◆ 4 could not find anything (time issue)
- ◆ 1 was inconclusive...
- ◆ Aircraft are needed.....

Oil disappeared?



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Other uses of the image data

- ◆ Wind Vector data for better forecasting...
- ◆ Target detection report (eg. illegal fishing) Lat and Long...Ship classification
Possible ship ID
- ◆ Fusion with
High Frequency Surface Wave Radar
Automatic Identification System

Detractors?

- ◆ Aircraft program folks sometimes feel “threatened”.
- ◆ Inability to provide assets to verify produces comments such as “we are making rods for our own behinds”
- ◆ More “hits” than we thought ...so....
- ◆ Some folks attack the “interpretation”.....

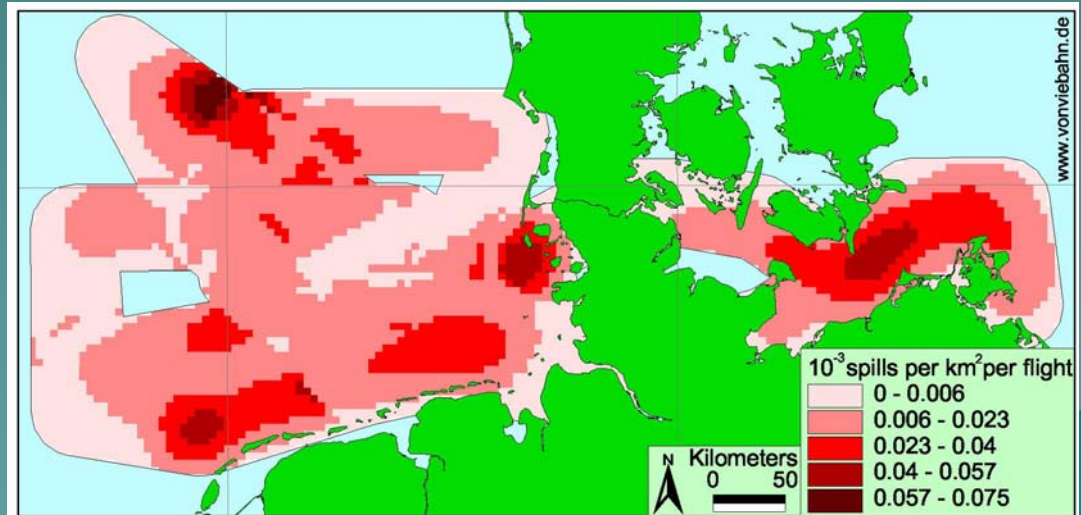
Lots of Questions still.....

- ◆ How many oil spills do we have in our area of responsibility each year?
- ◆ Is there an optimal “imaging plan” ?
- ◆ How to deal with the “false positives”.
- ◆ What is the spatial and regional distribution?
- ◆ Where are Hot-Spots?
- ◆ When is the highest incident rate (month, day)?
- ◆ How large is the quantity and density?

OCEANIDES

"Harmonised Monitoring, Reporting, And Assessment of Illegal Marine Oil Discharges"

- **Evaluation of satellite information** in terms of **reliability** and **completeness** of oil spill recognition in comparison with aircraft measurements,
- Definition of the **nomenclature** of the data,
- Providing time and space resolved **statistical density information** of spills and surveillance coverage,
- These **oil spill statistics** could be used to identify **trends in marine oil pollution**



Conclusion

- ◆ Our application is for ship source oil pollution.
- ◆ Using EO systems for this problem enables more surveillance coverage and more efficient tasking of our aircraft.
- ◆ Further integration of the needs of others and the fusion of data from other systems is being planned.
- ◆ Aircraft are essential to this process
- ◆ Lastly we do have some work on West Coast of Canada and offers collaboration opportunities

Questions?

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